

Evaluation Report

The Signing Science Dictionary
(NSF, Grant #HRD-0533057)

June 30, 2008

Project Description

The evaluation findings reported here focus on a beta version of the 1,300-term Signing Science Dictionary (SSD), developed by TERC and Vcom3D and funded, in part, by the National Science Foundation, Grant #0533057. The SSD is being developed to serve the approximately 50,000 students in grades 4-8 who are deaf and hard of hearing and require services under the Individuals with Disabilities Education Act (IDEA). For use with a Windows Operating System, the SSD is a complete assistive tool that can be used with an Internet connection or as a stand-alone. An animated interactive viewer—the SignSmith™ player—allows users to select from a range of Avatar characters with different personalities and facial expressions; to adjust the speed of signing; and to sign a selected word, its definition, or part of speech in American Sign Language (ASL) or as a word-for-word translation (Signed English [SE]).

Evaluation Goals

The primary intent of this field-test evaluation was to assess the degree to which students who used the SSD to perform activities related to a standards-based science unit in place in their school develop knowledge of the unit’s key vocabulary and of the content being studied. A secondary intent of the evaluation was to inform any necessary revision of the SSD before publication.

Research Design

The research design for the evaluation builds on the methodology established between TERC and EduMetrics for similar studies. The evaluation was coordinated by TERC and conducted by teachers solicited from a pool of upper elementary, middle grade, and high school teachers of students who are deaf and hard of hearing with a range of hearing loss. The pool included teachers who taught in specialized schools for the deaf and in settings where students were included in classrooms with hearing students.

A mixed measurement pre- post design that combines quantitative and qualitative methods in which the outcome of interest was measured for participants only was used with 4th through 11th grade students to ascertain the types of learning gains that are possible with use of the SSD. Findings in this report address learning outcomes demonstrated by changes in students’ mastery of key vocabulary for the unit of study as indicated by pre- and post-unit questions related to students’ ability to sign, understand, and communicate the terms identified as important for mastering the unit content. Content outcomes were assessed by responses on pre- and post-unit tests normally administered at the beginning and end of the unit. Qualitative feedback were supplied via written post-unit teacher and student surveys and analyzed to discern: (a) what teachers and students gained over the course of using the SSD; (b) their thoughts about usability and feasibility; and (c) what they liked and disliked about the SSD.

The research procedure for the field test involved placing the SSD in the designated classroom context with students who are deaf and hard of hearing at the intended grade levels. Research studies extended over the course of approximately 9 months from September 2007 through May 2008. The intent of the field test was to examine effectiveness of the SSD under

normal use conditions. To this end, each teacher identified at least one science unit to use for data collection. Pre- and post unit vocabulary lists, questionnaires, and scoring criteria were then developed by the teachers in collaboration with TERC. Tests normally administered at the end of the unit served as pre- and post-unit content questionnaires. These were submitted to TERC prior to beginning the unit and modified as needed. Teachers and students were given opportunities to provide qualitative and quantitative feedback and suggestions regarding ease of use, teacher/student gain, and likes and dislikes through post-use surveys. Teachers also tracked and rated each student's ability to work independently for a two-week period prior to using the SSD and while using it as High (3), Medium (2), or Low (1). Survey data provided additional information about use of the SSD and independence. The pre- and post unit vocabulary and content questionnaires and teacher and student post-use surveys are described in more detail in the following section.

Research Instruments

Student Pre- and Post Unit Vocabulary Questionnaire

A Pre-unit Vocabulary Questionnaire, which is identical to the Post-unit Vocabulary Questionnaire, was administered to obtain a baseline assessment of students' initial knowledge of their ability to sign, understand the meaning of, and use those terms that are important for developing ideas related to the unit content. Comparison of the scores on each questionnaire was used to ascertain changes in students' knowledge of the vocabulary. Note that only those students who completed both the pre- and post-unit questionnaires are included in this evaluation.

To develop the questionnaires, teachers completed a Pre-Teaching Survey in which they listed the key science terms students should know before and after doing the unit activities. They then communicated with TERC to share and refine the methods to be used to identify students' knowledge of these terms. Before doing the unit, teachers met one-on-one with each student to identify those terms the student could sign, match with its definition and/or an example/illustration of the term, and use in a sentence or paragraph. The matching and completion could be done in written English or sign. At the end of the unit, teachers repeated the process. Scores for each student were reported to TERC.

Student Pre- and Post Unit Content Questionnaire

A Pre-unit Content Questionnaire, which is identical to its post-unit counterpart, was administered to obtain a baseline assessment of students' initial knowledge about key unit topics. Comparison of the scores on each questionnaire was used to ascertain changes in students' mastery of the content. Only those students who completed both the pre- and post-unit questionnaires are included in this evaluation.

To develop the questionnaires, teachers completed a Pre-Teaching Survey in which they listed the unit learning goals. They then shared the test they usually administer at the end of the unit and the scoring criteria that would be used. The tests and scoring criteria were refined as required. Before doing the unit, teachers administered the test and sent the scored tests to TERC.

The test could be completed in written English or sign. At the end of the unit, teachers repeated the process.

Post-unit Teacher Survey

Completed after the unit, the Post-unit Teacher Survey asks teachers for feedback about their experiences using the SSD. The text of the survey follows.

1. How would you rate students' ability to find information in the SSD?

- very easy
- fairly easy
- possible with a little trial and error
- somewhat difficult
- impossible

2. How would you rate the SSD as a resource that complements and enriches instruction?

- Very Valuable
- Valuable
- Neutral
- Hardly Valuable
- Not at All Valuable

3. When did your students use the SSD?

- With a science activity
- For subjects other than science
- For homework or research
- Other (please specify):

4. How did your students use the SSD?

- Learn the definition of a word
- Learn how to sign a word
- Learn a part of speech
- Communicate the content being studied
- Do homework
- Other (please specify).

5. Do you think using the SSD improved students' self esteem and/or self confidence?

- Yes
- No

If yes, give an example.

6. Do you think using the SSD changed students' attitude toward science?

- Yes
- No

If yes, give an example.

7. How did you embed student use of the SSD into activities (pre-, during, at the end) and homework?
8. Did using the SSD help you accommodate different usages and learning styles? If yes, give an example.
9. Did using the SSD help you meet mandated curriculum frameworks? If yes, give an example.
10. Describe the value the SSD adds to teaching and learning – specifically in the areas of comprehending the content, communicating about a topic, and working independently.
11. What do you like about the SSD? What do you dislike?

Post-unit Student Survey

Completed after the unit, the Post-unit Student Survey asks students for feedback about their experiences about using the SSD. The text of the survey follows.

1. How easy was it to find information in the SSD?
 - Very easy
 - Fairly easy
 - Possible with a little trial and error
 - Somewhat difficult
 - Impossible
2. How did you use the SSD?
 - Learn the definition of a word
 - Learn how to sign a word
 - Learn a part of speech
 - See how things look
 - Tell what I know
 - Help me ask questions
 - Do homework
 - Other (please specify).
3. Why were you unable to find what you were looking for?
 - It was not there.
 - It was hard to find so I gave up.
 - Other (please specify)
4. Tell us how you found information in the SSD?
5. Tell us what you like about the SSD? What do you dislike?

Demographics

The evaluation study included a sample of 122 students distributed among 15 treatment groups. A summary of demographic information about the treatment groups and the topic of study is presented in Table 1. Table 2 shows the distribution of students by treatment group and levels of hearing loss.

Table 1. Treatment Groups

<i>Group #</i>	<i>Grade(s)</i>	<i>Geographic Region</i>	<i>Setting</i>	<i>N</i>	<i>School/Classroom Type</i>	<i>Unit Topic</i>
1	4	Midwest	rural	3	inclusion	weather
2	5	South	urban	12	specialized	electricity
3	5	South	urban	3	inclusion	landforms
4	6	Midwest	urban	2	specialized	rocks
5	7	Midwest	rural	8	specialized	environment
6	7	Midwest	urban	8	specialized	weather
7	8	Midwest	rural	6	specialized	matter
8	8	Midwest	urban	4	specialized	forces/motion
9	4/5	Midwest	urban	9	specialized	solar system
10	5/6	Midwest	rural	4	inclusion	energy
11	6/7/8	West	urban	8	specialized	earth and sky
12	4/5/6/7/8	East	urban	9	specialized	weather
13	9/10	Midwest	suburban	15	self-contained	ecology
14	9/10/11	Midwest	suburban	16	self-contained	cells
15	9/10/11	South	rural	15	specialized	living things

Table 2. Levels of Hearing Loss

<i>Group #</i>	<i>Mild (27-40dB)</i>	<i>Moderate (41-55dB)</i>	<i>Moderate-Severe (56-70dB)</i>	<i>Severe (71-90dB)</i>	<i>Profound (91dB+)</i>
1		1		1	1
2		2		10	
3				2	1
4				1	1
5		4			4
6				2	6
7				4	2
8				2	2
9				9	
10				3	1
11		1			7
12	2	4		1	2
13				5	10
14		1		5	10
15		2		10	3

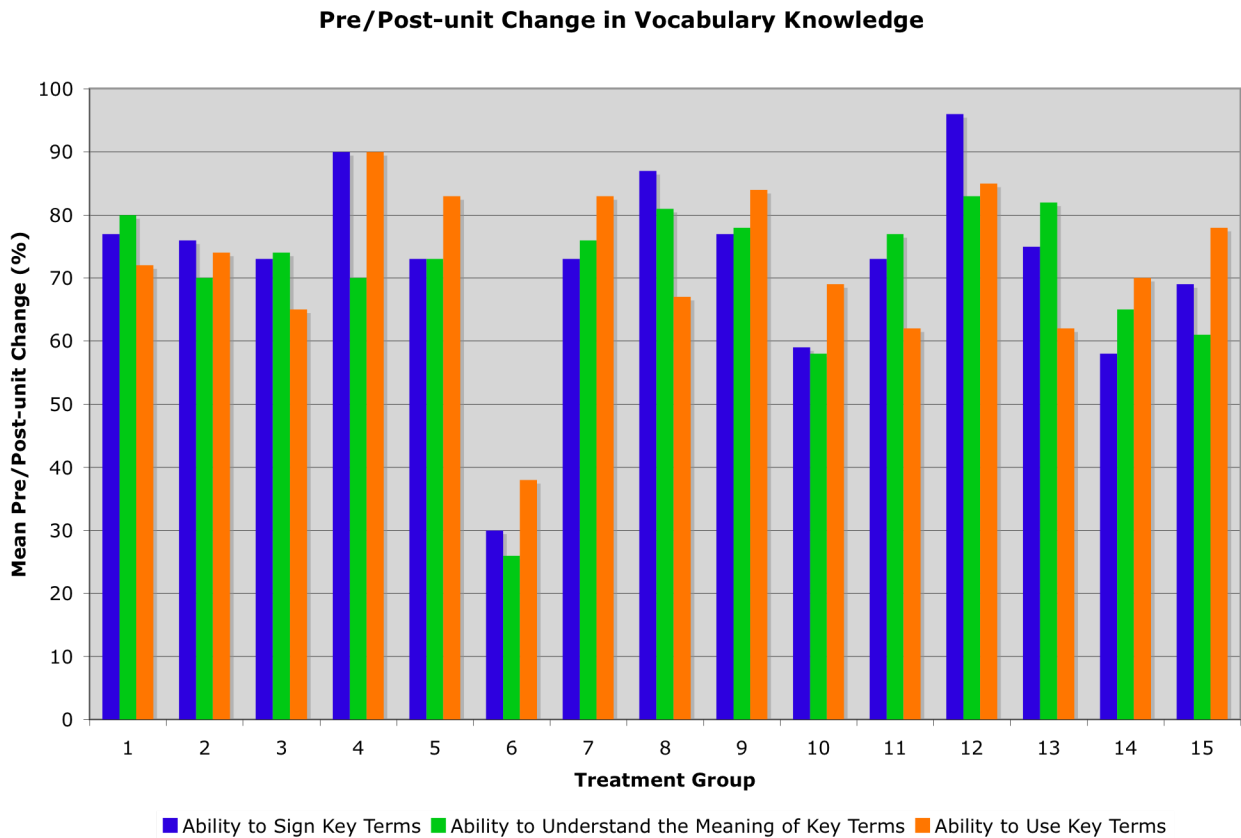
Findings

As previously specified, student and teacher data were collected over the course of the study. Findings about use of the SSD and degree of mastery of the vocabulary and content being studied and between use of the SSD and students' ability to work independently are reported in the following pages.

Vocabulary Knowledge

As Table 3 reveals, the ability of each treatment group to sign using a recognized sign, understand the meaning of, and use the key terms for the unit of study increased from pre- to post-unit assessment. These results indicate that the SSD serves as a bridge to help fill the language gap many students who are deaf and hard of hearing experience in doing science.

Table 3



Tables 4-18 summarize the data for each treatment group. As these tables reveal, each group had significantly improved post-unit scores compared to their pre-unit results as tested by a paired *t*-test. Thus, their ability to sign, understand, and communicate the key vocabulary for the unit increased significantly with use of the SSD over the course of the study, on average. As Table 9 reveals, Treatment Group 6 had significantly improved post-unit scores compared to

their pre-unit results. However, their pre-use means were higher than those of the other groups, leaving less room for improvement. Although the SSD includes key standards-based terms identified from a core set of standards-based science materials for grades 4-8, as Tables 16-18 reveal, students in grades 9-11 who used the SSD also had significantly improved pre- to post-unit vocabulary scores.

Treatment Group 1

Grade 4—Inclusion Classroom

Unit of Study—Weather

Key Unit Terms—*thermometer, troposphere, water cycle, weather, wind, wind vane*

Table 4. Treatment Group 1 Data Summary (Vocabulary)

<i>Ability to...</i>	<i>Possible # of Terms</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Sign	6	3	0.7 (0.6)	5.3 (0.6)	+ 4.6	t(2)=14, <i>p</i> =.0025	+ 77%
Understand	6	3	0.2 (0.6)	5.0 (0.0)	+ 4.8	t(2)=11, <i>p</i> =.0041	+ 80%
Use	6	3	0.7 (0.6)	5.0 (0.0)	+ 4.3	t(2)=13, <i>p</i> =.0029	+ 72%

*Standard Deviation

**Paired t-Test—A *p* level ≤.05 indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 2

Grade 5—School for the Deaf

Unit of Study—Electricity

Key Unit Terms—*conductor, electric charge, electric circuit, electric current, magnet, motor, static electricity*

Table 5. Treatment Group 2 Data Summary (Vocabulary)

<i>Ability to...</i>	<i>Possible # of Terms</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Sign	7	12	0.9 (0.9)	6.2 (0.8)	+5.3	t(11)=15, <i>p</i> ≤.0001	+76%
Understand	7	12	1.1 (0.8)	6.0 (0.9)	+4.9	t(11)=25, <i>p</i> ≤.0001	+70%
Use	7	12	0.6 (0.5)	5.8 (0.8)	+5.2	t(11)=18, <i>p</i> ≤.0001	+74%

*Standard Deviation

**Paired t-Test—A *p* level ≤.05 indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 3

Grade 5—Inclusion Classroom

Unit of Study—Landforms

Key Unit Terms—*alluvial plain, atmosphere, avalanche, conservation effort, canyon, crater, crest, crust, current, earthquake, erosion, fault, flood, hot spot, hurricane, hydrosphere, inner core, landform, landslide, mantle, Mid-Atlantic rift, Mid-ocean ridge, moraine, outer core, plateau, pollution, relief map, rift, Ring of Fire, seamount, stream, tectonic plate, topographical map, trench, tributary, trough, tsunami, volcano, volcanic eruption, weathering*

Table 6. Treatment Group 3 Data Summary (Vocabulary)

<i>Ability to...</i>	<i>Possible # of Terms</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Sign	40	3	1.7 (2.1)	31.0 (3.6)	+ 29.3	t(2)=33, p =.0004	+ 73%
Understand	40	3	2.3 (0.6)	31.7 (2.1)	+ 29.4	t(2)=33, p =.0004	+ 74%
Use	40	3	2.7 (1.5)	28.7 (3.1)	+ 26.0	t(2)=17, p =.0017	+ 65%

*Standard Deviation

**Paired t-Test—A *p* level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 4

Grade 6—School for the Deaf

Unit of Study—Rocks

Key Unit Terms—*igneous, metamorphic rock, rock cycle, sedimentary rock, sediment*

Table 7. Treatment Group 4 Data Summary (Vocabulary)

<i>Ability to...</i>	<i>Possible # of Terms</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Sign	5	2	0.5 (0.7)	5.0 (0.0)	+ 4.5	t(1)=9, p =.0352	+ 90%
Understand	5	2	1.0 (0.0)	4.5 (0.7)	+ 3.5	t(1)=7, p =.0451	+ 70%
Use	5	2	0.5 (0.7)	5.0 (0.0)	+ 4.5	t(1)=9, p =.0352	+ 90%

*Standard Deviation

**Paired t-Test—A *p* level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 5

Grade 7—School for the Deaf

Unit of Study—Environment

Key Unit Terms—*abiotic factors, biotic factors, community, ecosystem, environment, habitat, organism, population*

Table 8. Treatment Group 5 Data Summary (Vocabulary)

<i>Ability to...</i>	<i>Possible # of Terms</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Sign	8	8	1.6 (1.1)	7.4 (0.5)	+ 5.8	t(7)=12, p \leq .0001	+ 73%
Understand	8	8	1.4 (1.3)	7.4 (0.5)	+ 6.0	t(7)=7, p \leq .0001	+ 75%
Use	8	8	0.6 (0.5)	7.2 (0.8)	+ 6.6	t(7)=11, p \leq .0001	+ 83%

*Standard Deviation

**Paired t-Test—A *p* level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 6

Grade 7—School for the Deaf

Unit of Study—Weather

Key Unit Terms—*air mass, air pressure, barometer, blizzard, condensation, evaporation, front, humidity, hurricane, meteorologist, precipitation, radar, storm surge, thunderstorm, tornado, tropical storm*

Table 9. Treatment Group 6 Data Summary (Vocabulary)

<i>Ability to...</i>	<i>Possible # of Terms</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Sign	16	8	10.5 (0.5)	15.3 (0.5)	+ 4.8	t(7)=19, $p \leq .0001$	+ 30%
Understand	16	8	11.6 (0.5)	15.8 (0.5)	+ 4.2	t(7)=18, $p \leq .0001$	+ 26%
Use	16	8	7.1 (0.8)	13.1 (1.0)	+ 6.0	t(7)=19, $p \leq .0001$	+ 38%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 7

Grade 8—School for the Deaf

Unit of Study—Matter

Key Unit Terms—*atom, flow, gas, liquid, matter, molecule, states of matter, solid*

Table 10. Treatment Group 7 Data Summary (Vocabulary)

<i>Ability to...</i>	<i>Possible # of Terms</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Sign	8	6	1.6 (1.1)	7.4 (0.5)	+ 5.8	t(5)=12, $p \leq .0001$	+ 73%
Understand	8	6	1.4 (1.3)	7.5 (0.6)	+ 6.1	t(5)=41, $p \leq .0001$	+ 76%
Use	8	6	0.6 (0.5)	7.2 (0.8)	+ 6.6	t(5)=12, $p \leq .0001$	+ 83%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 8

Grade 8—School for the Deaf

Unit of Study—Forces/Motion

Key Unit Terms—*acceleration, centripetal force, force, inertia, Newton’s first law, Newton’s second law, Newton’s third law, speed, velocity*

Table 11. Treatment Group 8 Data Summary (Vocabulary)

<i>Ability to...</i>	<i>Possible # of Terms</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Sign	9	4	1.0 (0.8)	8.8 (0.5)	+ 7.8	t(3)=31, $p \leq .0001$	+ 87%
Understand	9	4	1.5 (1.3)	8.8 (0.5)	+ 7.3	t(3)=15, $p = .0003$	+ 81%
Use	9	4	2.0 (0.8)	8.0 (0.8)	+ 6.0	N/A***	+ 67%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

***There is no variability in the difference between pre- to post test scores in the sample.

Treatment Group 9

Grades 4/5—School for the Deaf

Unit of Study—Solar System

Key Unit Terms—*Earth, Jupiter, Mars, Mercury, moon, Neptune, Saturn, sun, Pluto, solar system, Uranus, Venus*

Table 12. Treatment Group 9 Data Summary (Vocabulary)

<i>Ability to...</i>	<i>Possible # of Terms</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Sign	12	9	1.9 (1.1)	11.1 (1.4)	+ 9.2	t(8)=41, $p \leq .0001$	+ 77%
Understand	12	9	1.9 (1.1)	11.3 (0.9)	+ 9.4	t(8)=39, $p \leq .0001$	+ 78%
Use	12	9	0.0 (0.0)	10.1 (1.2)	+ 10.1	t(8)=26, $p \leq .0001$	+ 84%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 10

Grades 5/6—Inclusion Classroom

Unit of Study—Energy

Key Unit Terms—*alternative energy, burn, coal, conserve energy, energy, fossil fuel, fuel, gas, heat, hydropower, kinetic energy, light, liquid, mine, motion, natural gas, nuclear power, oil, produce, potential energy, solar power, solid, store, wind power, work*

Table 13. Treatment Group 10 Data Summary (Vocabulary)

<i>Ability to...</i>	<i>Possible # of Terms</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Sign	25	4	4.8 (2.2)	19.5 (2.1)	+ 14.7	t(3)=10, $p = .0008$	+ 59%
Understand	25	4	4.5 (2.6)	18.8 (2.2)	+ 14.3	t(3)=15, $p = .0003$	+ 58%
Use	25	4	3.8 (2.2)	21.0 (2.6)	+ 17.2	t(3)=10, $p = .0009$	+ 69%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 11

Grades 6/7/8, Area—School for the Deaf

Unit of Study—Earth and Sky

Key Unit Terms—*axis, cause, continent, Equator, hemisphere, North Pole, rotate, Standard Time Zone, South Pole*

Table 14. Treatment Group 11 Data Summary (Vocabulary)

<i>Ability to...</i>	<i>Possible # of Terms</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Sign	9	8	0.5 (1.4)	7.1 (0.8)	+ 6.6	t(7)=14, $p \leq .0001$	+ 73%
Understand	9	8	0.5 (1.4)	7.4 (1.3)	+ 6.9	t(7)=11, $p \leq .0001$	+ 77%
Use	9	8	0.5 (1.4)	6.1 (1.1)	+ 5.6	t(7)=15, $p \leq .0001$	+ 62%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 12

Grades 4/5/6/7/8—School for the Deaf

Unit of Study—Weather

Key Unit Terms—*air, air pressure, atmosphere, climate, gas, invisible, meteorologist, moisture, temperature, troposphere, weather, wind*

Table 15. Treatment Group 12 Data Summary (Vocabulary)

<i>Ability to...</i>	<i>Possible # of Terms</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Sign	12	9	0.5 (1.4)	12.0 (0.0)	+ 11.5	t(8)=23, $p \leq .0001$	+ 96%
Understand	12	9	2.1 (1.0)	12.0 (0.0)	+ 9.9	t(8)=28, $p \leq .0001$	+ 83%
Use	12	9	1.8 (0.7)	12.0 (0.0)	+ 10.2	t(8)=41, $p \leq .0001$	+ 85%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 13

Grades 9/10—Self-contained Classroom

Unit of Study—Ecology

Key Unit Terms—*abiotic, biome, biotic, carnivore, community, decompose/decay, ecosystem, environment, habitat, herbivore, interact, niche, omnivore, predator, prey, producer, scavenger, species*

Table 16. Treatment Group 13 Data Summary (Vocabulary)

<i>Ability to...</i>	<i>Possible # of Terms</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Sign	18	15	2.3 (1.3)	15.8 (2.6)	+ 13.5	t(14)=18, $p \leq .0001$	+ 75%
Understand	18	15	4.3 (2.0)	14.7 (2.9)	+ 10.4	t(14)=11, $p \leq .0001$	+ 82%
Use	18	15	2.6 (1.4)	13.7 (1.2)	+ 11.1	t(14)=20, $p \leq .0001$	+ 62%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 14

Grades 9/10—Self-contained Classroom

Unit of Study—Cells

Key Unit Terms—*cell, cell membrane, cell wall, chloroplast, chlorophyll, chromosome, cytoplasm, diffusion, DNA, element, endoplasmic reticulum, function, Golgi body, lysosome, mitochondria, mitosis, molecule, nucleus, nuclear membrane, organelle, ribosome, structure, transport, unicellular, vacuole*

Table 17. Treatment Group 14 Data Summary (Vocabulary)

<i>Ability to...</i>	<i>Possible # of Terms</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Sign	25	16	3.3 (1.0)	17.8 (2.2)	+ 14.5	t(15)=24, $p \leq .0001$	+ 58%
Understand	25	16	1.6 (1.5)	17.9 (2.6)	+ 16.3	t(15)=22, $p \leq .0001$	+ 65%
Use	25	16	0.3 (0.6)	17.8 (2.3)	+ 17.5	t(15)=28, $p \leq .0001$	+ 70%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 15

Grades 9/10/11—School for the Deaf

Unit of Study—Living Things

Key Unit Terms = *adapt, anatomy, biology, botany, cell, characteristic, energy, equipment, hibernate, homeostasis, instinct, interact, matter, offspring, organism, physiology, reproduce, respond, specialization*

Table 18. Treatment Group 15 Data Summary (Vocabulary)

<i>Ability to...</i>	<i>Possible # of Terms</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Sign	19	15	4.9 (2.1)	18.0 (1.5)	+ 13.1	t(14)=19, p ≤.0001	+ 69%
Understand	19	15	3.8 (1.3)	15.3 (3.1)	+ 11.5	t(14)=13, p ≤.0001	+ 61%
Use	19	15	1.1 (1.4)	15.8 (1.1)	+ 14.7	t(14)=37, p ≤.0001	+ 78%

*Standard Deviation

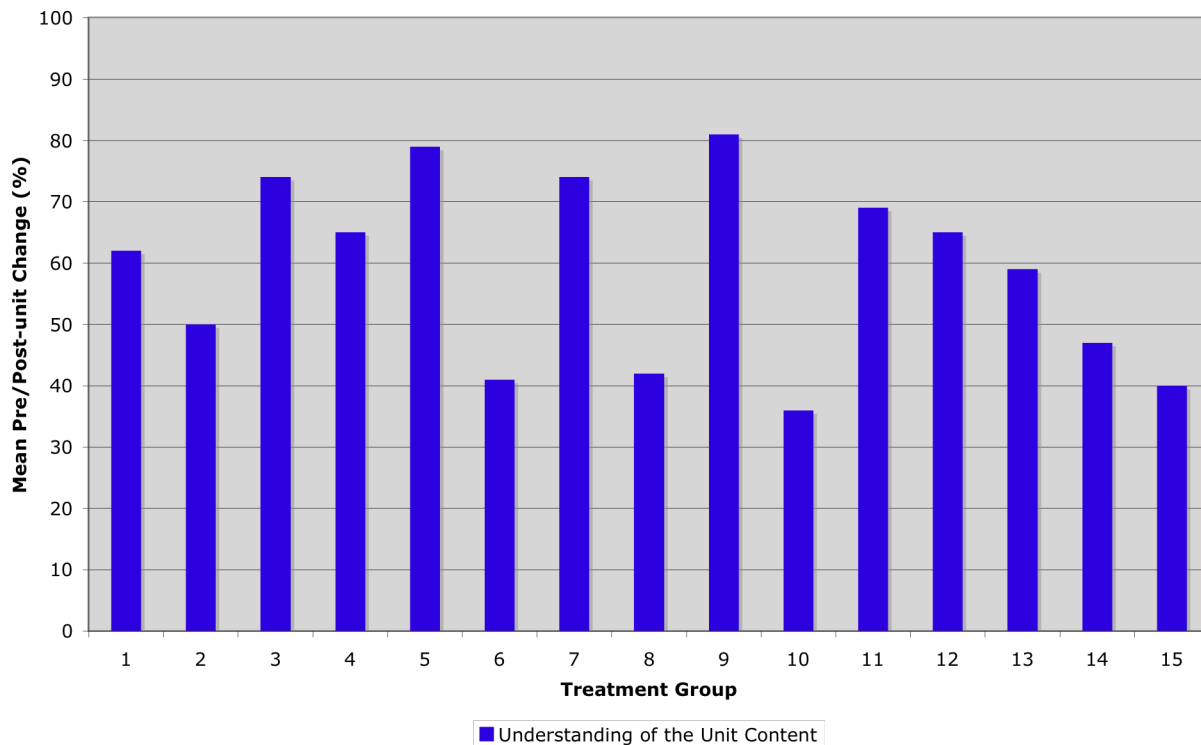
**Paired t-Test—A p level ≤.05 indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Content Knowledge

As Table 19 reveals, each treatment group’s knowledge of the unit content increased from pre- to post-unit assessment.

Table 19

Pre/Post-unit Change in Content Knowledge



Tables 20-34 summarize the data for each treatment group. As these tables reveal, each group had significantly improved post-unit scores compared to their pre-unit results as tested by a paired *t*-test. Thus, their knowledge of the unit content increased significantly with use of the SSD over the course of the study, on average. Although the SSD was developed for grades 4-8, as Tables 32-34 reveal, students in grades 9-11 who used the SSD also had significantly improved pre- to post-unit content scores.

Treatment Group 1

Grade 4—Inclusion Classroom

Unit of Study—Weather

Goals— Students will: (1) Understand the factors that determine weather. (2) Identify instruments used to describe weather and know what each instrument measures.

Test Type—Multiple Choice/Fill-in

Table 20. Treatment Group 1 Data Summary (Content)

	<i>Possible Points</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Content Knowledge	20	3	5.0 (0.0)	17.3 (1.5)	+ 12.3	t(2)=31, p =.0005	+ 62%

*Standard Deviation

**Paired t-Test—A *p* level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 2

Grade 5—School for the Deaf

Unit of Study—Electricity

Goals— Students will: (1) Identify ways to be safe with magnets and electricity. (2) Understand what kind of work a magnet or electricity can do. (3) Name the parts of an electrical circuit. (4) Determine what causes static electricity.

Test Type— True/False; Multiple choice

Table 21. Treatment Group 2 Data Summary (Content)

	<i>Possible Points</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Content Knowledge	10	12	3.9 (0.8)	8.9 (0.8)	+ 5.0	t(11)=11, p $\leq .0001$	+ 50%

*Standard Deviation

**Paired t-Test—A *p* level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 3

Grade 5—Inclusion Classroom

Unit of Study—Landforms

Goals— Students will: (1) Explain how natural processes affect Earth’s oceans and land. (2) Illustrate the landforms of the ocean floor. (3) Compare continental and oceanic landforms. (4) Explain how water affects the shore zone. (5) Compare the movement of water. (6) Explain the effects of how human activity on the land and oceans.

Test Type—Short Answer

Table 22. Treatment Group 3 Data Summary (Content)

	<i>Possible Points</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Content Knowledge	50	3	2.0 (2.0)	39.0 (4.6)	+ 37	t(2)=11, p =.0037	+ 74%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 4

Grade 6—School for the Deaf

Unit of Study—Rocks

Goals—Students will: (1) Describe the rock cycle and explain that there are sedimentary, igneous, and metamorphic rocks that have distinct properties and are formed in different ways. (2) Explain that rocks are made of one or more materials.

Test Type—Matching

Table 23. Treatment Group 4 Data Summary (Content)

	<i>Possible Points</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Content Knowledge	10	2	1.0 (1.4)	7.5 (0.7)	+ 6.5	t(1)=13, p =.0244	+ 65%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 5

Grade 7—School for the Deaf

Unit of Study—Environment

Goals—Students will: (1) Understand that all of the organisms living together and the physical factors with which they interact compose an ecosystem.

Test Type— Multiple Choice

Table 24. Treatment Group 5 Data Summary (Content)

	<i>Possible Points</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Content Knowledge	15	8	2.1 (1.1)	13.9 (0.7)	+ 11.8	t(7)=16, p \leq .0001	+ 79%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 6

Grade 7—School for the Deaf

Unit of Study—Weather

Goals—Students will: (1) Make simple weather predictions. (2) Determine how weather observations and measurements are combined to produce weather maps. (3) Read a weather map. (4) Describe the connection between the water cycle and weather-related phenomena.

Test Type— Matching

Table 25. Treatment Group 6 Data Summary (Content)

	<i>Possible Points</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Content Knowledge	15	8	5.3 (3.2)	11.5 (1.4)	+ 6.2	t(7)=6, p =.0001	+ 41%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 7

Grade 8—School for the Deaf

Unit of Study—Matter

Goals—Students will: (1) Understand that materials can exist in different states-solid, liquid, and gas. (2) Explain the change of a material from one state to another through heating and cooling.

Test Type— Multiple Choice

Table 26. Treatment Group 7 Data Summary (Content)

	<i>Possible Points</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Content Knowledge	50	6	5.2 (3.9)	42.2 (2.9)	+ 37.0	t(5)=18, p \leq .0001	+ 74%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 8

Grade 8—School for the Deaf

Unit of Study—Forces/Motion

Goals—Students will: (1) Explain that motion describes the change in the position of an object as time changes. (2) Explain that when an unbalanced force acts on an object, it changes that object's speed and/or direction.

Test Type— Matching

Table 27. Treatment Group 8 Data Summary (Content)

	<i>Possible Points</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Content Knowledge	10	4	2.8 (2.2)	7.0 (1.4)	+ 4.2	t(3)=5, p =.0054	+ 42%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 9

Grades 4/5—School for the Deaf

Unit of Study—Solar System

Goals—Students will: (1) Name and identify the sun, moon, and planets. (2) Correctly order the planets.

Test Type— Identification; Fill in

Table 28. Treatment Group 9 Data Summary (Content)

	<i>Possible Points</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Content Knowledge	23	9	2.3 (1.5)	21.0 (2.2)	+ 18.7	t(8)=28, $p \leq .0001$	+ 81%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 10

Grades 5/6—Inclusion Classroom

Unit of Study—Energy

Goals—Students will: (1) Understand how energy affects our lives. (2) Understand the states of matter. (3) Categorize energy sources as heat, light, or motion. (4) Explain how energy can be transformed from one form to another. (5) List ways to conserve energy. (6) Be able to read an energy (electric and gas) bill. (7) Explain and demonstrate how alternative energy sources work.

Test Type—Short answer; Fill in; Matching

Table 29. Treatment Group 10 Data Summary (Content)

	<i>Possible Points</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Content Knowledge	80	4	35.5 (10.8)	64.5 (3.4)	+ 29.0	t(3)=14, $p = .0079$	+ 36%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 11

Grades 6/7/8, Area—School for the Deaf

Unit of Study—Earth and Sky

Goals—Students will: (1) Describe Earth’s shape and features. (2) Explain causes of day/night.

Test Type—Fill in

Table 30. Treatment Group 11 Data Summary (Content)

	<i>Possible Points</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Content Knowledge	50	8	2.8 (7.8)	37.1 (6.0)	+ 34.3	t(7)=14, $p \leq .0001$	+ 69%

*Standard Deviation

**Paired t-Test—A p level $\leq .05$ indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 12 Data Summary

Grades 4/5/6/7/8—School for the Deaf

Unit of Study—Weather

Goals—Students will: (1) Explain weather as the interaction of moisture, air temperature, air pressure, and wind. (2) Describe how water moves between Earth’s surface and the air. (3) Define air temperature. (4) Describe air pressure. (5) Describe wind.

Test Type—Short Answer

Table 31. Treatment Group 12 Data Summary (Content)

	<i>Possible Points</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Content Knowledge	20	9	5.4 (2.8)	18.4 (1.5)	+ 13.0	t(8)=16, p ≤.0001	+ 65%

*Standard Deviation

**Paired t-Test—A *p* level ≤.05 indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 13

Grades 9/10—Self-contained Classroom

Unit of Study—Ecology

Goals—Students will: (1) Understand the flow of energy through an ecosystem. (2) Explain the relationship between predator and prey. (3) Understand the major components of an ecosystem. (4) Identify and describe how species interact within an ecosystem.

Test Type—Matching; Multiple choice; Short answer

Table 32. Treatment Group 13 Data Summary (Content)

	<i>Possible Points</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Content Knowledge	94	15	20.8 (7.3)	75.7 (6.8)	+ 54.9	t(14)=28, p ≤.0001	+ 59%

*Standard Deviation

**Paired t-Test—A *p* level ≤.05 indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 14

Grades 9/10—Self-contained Classroom

Unit of Study—Cells

Goals—Students will: (2) Identify parts of the cell and describe their functions. (3) Compare and contrast plant cells and animal cells. (4) Describe and relate the structure and functions of different kinds of cells. (5) Describe and show how cells reproduce. (6) Understand how different elements and molecules are used in the cell.

Test Type— Multiple choice; Short answer; Essay

Table 33. Treatment Group 14 Data Summary (Content)

	<i>Possible Points</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Content Knowledge	90	16	17.9 (6.4)	59.9 (10.5)	+ 42.0	t(15)=16, p ≤.0001	+ 47%

*Standard Deviation

**Paired t-Test—A *p* level ≤.05 indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Treatment Group 15

Grades 9/10/11—School for the Deaf

Unit of Study—Living Things

Goals—(1) Identify the six characteristics of living things. (2) Explain what living things need to survive and reproduce. (3) Understand where living things come from.

Test Type—Multiple choice; Short answer

Table 34. Treatment Group 15 Data Summary (Content)

	<i>Possible Points</i>	<i>N</i>	<i>Pre-unit Mean (sd)*</i>	<i>Post-unit Mean (sd)*</i>	<i>Mean Difference</i>	<i>Statistical Significance**</i>	<i>Mean Change (%)</i>
Content Knowledge	60	15	22.2 (7.3)	46.0 (7.7)	+ 23.8	t(14)=10, p ≤.0001	+ 40%

*Standard Deviation

**Paired t-Test—A *p* level ≤.05 indicates a treatment affect occurred (post-use scores are significantly higher than pre-use scores).

Ability to Work Independently

As previously specified, teachers provided information about students' ability to work independently during a two-week period prior to using the SSD and while using it. They rated each student's ability during the period as 1: Low— Able to complete activities and homework with much assistance; 2: Medium— Able to complete activities and homework with some assistance; 3: High— Able to complete activities and homework with little to no assistance. As Table 35 reveals, students' ability to work independently shifted toward being more able to complete activities and homework independently with use of the SSD.

Table 35. Ability to Work Independently

	<i>N</i>	<i>Low (1)</i>	<i>Medium (2)</i>	<i>High (3)</i>
Pre-use	122	46	65	11
Post-use	122	11	69	42

Post-use Teacher Feedback

As previously specified, teachers provided feedback via post-use surveys about their experiences with the SSD. The following summarizes their written responses to this inquiry (N=11).

1. How would you rate students' ability to find information in the SSD?
Very easy—5
Fairly easy—6
2. How would you rate the SSD as a resource that complements and enriches instruction?
Very Valuable—11
3. When did your students use the SSD?
With a science activity—10; For homework or research—7; For subjects other than science—3; For test practice—1

4. How did your students use the SSD?

Learn the definition of a word—11; Learn how to sign a word—11; Learn a part of speech—4; Do homework—7; Communicate the content being studied—6

5. Do you think using the SSD improved students' self esteem and/or self confidence?

Yes—11

"Many students used the SSD independently on a daily basis to improve their signing ability."

"They were able to find the word themselves instead of asking for help."

"They were amazed that they could look up words in their own language. They really like the avatars and had fun using them to learn words that were hard for them. They also liked being able to use the avatar to validate that they knew how to sign a term and its meaning. They also made up a game to use the avatar to test one another."

"They felt that this was a special dictionary just for them; they could look for information on their own in their first language."

"They were able to keep individual word lists. It was fun for them to see their vocabulary grow and became sort of a contest to see who could sign or knew the most words at the end of the week. They even played a 'Do you know?' vocabulary game. I'd never seen them do anything like this!"

6. Do you think using the SSD changed students' attitude toward science?

Yes—6

No—5

"They loved the avatars and want to have them for their other classes. Therefore, I would say that the SSD positively changed their attitude toward science, and in learning."

"They wanted to learn new signs for the 'big' science words and be able to use them."

"I do not believe the SSD changed students' attitudes towards science *per se*. They already enjoy science. What is changed was their willingness to tackle new vocabulary and reading in the area of science so that learning science became a much more rewarding and successful experience."

7. How did you embed student use of the SSD into activities (pre-, during, at the end) and homework?

"I gave students the vocabulary for the unit prior to doing it and had them write the definitions that were in the SSD instead of using the print dictionary. They liked doing the vocabulary much more this way. It held their interest, and they could do it without asking me to sign for them."

"I wrote the key vocabulary words for each activity on a 'white board' before we did the activity. We used the SSD to learn the sign for the word and discuss the sign. We then used the definition and picture to develop a beginning understanding of the meaning of the word. I encouraged students to go back to the SSD independently during and after the activity to check their understanding and use it to record ideas in their notebooks and to help them communicate their ideas in sign and writing. They also used it to 'prove they were right' to me and other students."

“Before an activity, I used flashcards to test for knowledge of the terms students needed to know before doing it. Then we went to the SSD to find out how to sign the term and what it means. At the end of the activity, we repeated these steps. I also had them use the term in a combination of English and sign to answer homework and test questions. This helped me see whether they could understand and use each of the key terms.”

“Prior to the Unit: I made them look up the words that are important during the unit and define them. During the Unit: They used the SSD to write sentences and fill in the blanks with the correct response. End of the Unit: They used the SSD to review words for the test that they still struggled with.”

“I used it as a pre test, for practice during the units, and as a post test. I’m not a science specialist and used it to check the signing and definitions of terms before teaching the unit and during teaching.”

“Pre-learning of vocabulary—students had a worksheet developed from the information from the SSD which they filled in. During—we referred back to the SSD if students did not remember a word.”

“This (landforms) was a very long unit and took the entire first semester to complete. I divided the long list of key terms into sub-lists that covered unit sub-topics such as natural processes and human activity. We used the SSD to learn the sign for the terms in the sub-list and a beginning definition. Students added to the definition and incorporated new words and definitions into their lists as the unit went along. It did not take them long to figure out how to keep and use their own lists.”

8. Did using the SSD help you accommodate different usages and learning styles?

“It was much easier for my students with low reading levels to use the SSD than to try to find and understand the definitions in the print dictionary.”

“I accommodated different learning styles by having some students just look up the word itself while I had others learn the definition and use the word in a sentence.”

“The SSD enables students to be better able to comprehend content and to also learn the appropriate sign for the science content words. It allows students to independently use a dictionary to look up the meaning of a word and actually be able to understand the definition. In a print dictionary, the student often cannot read the words that are being used to define the word the student is looking up. This dictionary overcomes that limitation, and all students are actually able to look up a word and learn its meaning and proper sign. This is an enormous benefit to the student. The student is then better able to pursue whatever educational activity in which he may be engaged, be it research, writing about a topic, or surfing the web.”

“The pictures really helped us talk about a word and its meaning. It also enabled communication because students could choose ASL or SE.”

“Those who are more independent were able to use it while I worked with others. It helped make things visual. It allowed students to choose ASL or Signed English. The English and ASL supported each other so students could choose either one. The pictures helped support the English/ASL which helped visual learners.”

“The SSD allowed the hard of hearing/English-speaking child to see the information in Signed English and the Deaf children to see the terms explained in ASL. The pictures were good for everyone.”

9. Did using the SSD help you meet mandated curriculum frameworks? If yes, give an example.

“The words fell right into the specific unit I was teaching.”

“The SSD is a great aid for the teacher because it helps us use the correct sign for the science terms and standardizes the sign’s use. Too often teachers make up a sign for a word if they do not know the sign. Because science has a very specialized vocabulary, often teachers may not know the appropriate sign for the science content words when implementing instructional material.”

“All of the words we needed were right there. Also, it gave me a resource I could use to check the signs and definitions and have confidence that they are correct.”

“The SSD definitely helped me meet the mandated curriculum frameworks. I used it to check my own signing and knowledge of the content before teaching. It also helped my students learn the content from studying the definitions and pictures that went along with them.”

10. Describe the value the SSD adds to teaching and learning – specifically in the areas of comprehending the content, communicating about a topic, and working independently.

“The SSD helped students become familiar with the words they needed to use for the unit so they could concentrate on learning and on what they were doing rather than having to stop and ask me for help every time they were stuck.”

“The SSD adds value to teaching and learning because it is good for students to see the word in sign and visually so that they do not have to rely only on the printed word.”

“In a print dictionary, the student often cannot read the words that are being used to define the word the student is looking up. This dictionary overcomes that limitation, and students are actually able to look up a word and its meaning without having to engage the teacher (or other adult) to ‘translate’ a written definition into sign. This is an enormous benefit to the student. Students who have computer access at home can also use the dictionary to aid in completing homework tasks. Most parents do not sign, so meaningful help is often not available to the child at home.”

“The avatars held their attention and motivated them to spend more time working with the material. They did not rely so much on me and enjoyed the activities more.”

“The SSD allows the students to work more independently as they struggle when using an English dictionary. It allows them to have a better understanding of the content as it is given in ASL.”

“Students can find a sign or definition independently without having to wait for a teacher. The definitions can help them comprehend homework. Knowing the terms helps students to communicate the topic in later lessons since they were able to learn the sign from the dictionary.”

“The SSD helped students by providing the opportunity for independent practice. It helped the whole group use the same sign.”

“All of my students like the dictionary and used it for the rest of the year during activities and for research and homework.”

11. What do you like about the SSD? What do you dislike?

“I really like ease of use, the range of items that can be customized, and the clear signing. In the case where a word was not there, it went to the closest word. This confused some students. It might be better to only go to the exact word.”

“The best thing about the SSD is that students are able to use it to independently learn the correct sign and meaning for science terms. I especially like being able to look up a sign for a science term and be sure I’m using the correct sign.”

“I like being able to adjust the pace of the signing and being able to select ASL or SE. I dislike not being able to find some of the common easy words that my students should know, but don’t.”

“We like everything about the SSD. I look forward to the addition of even more words and having signing dictionaries for math and other classes.”

“I like having the definitions available as most resources only have the sign for the term and cannot be used to help students understand the content they are studying or prepare them for what they will be learning. I like having the range of terms available as a resource for all of my students, especially the ones with lower language levels.”

“The pictures that went along with the vocabulary terms were very helpful and visual. I expected a real person to do the signing. First, I was disappointed. But after I got used to it, I was surprised that I really liked using the avatar, especially since the characters held the interest of my students.”

“Liked: Signed English and ASL are available; can see just the sign or watch the definition; can click on any word in definition to see the sign; ability to adjust colors, speed, signer; quite a variety of words—hope for even more in the future.” Disliked: there were some signing discrepancies—for example ‘gas’—if you go to the word gas to see the sign and definition, it is finger-spelled; but if the word ‘gas’ is used in a definition for another word, it was signed. Students wouldn’t understand that because they had learned it from the dictionary as finger-spelled.” (Note: This “bug” has been corrected.)

“I found it very difficult to use the SSD as often as I would have liked due to the education taking place in the general classroom. Therefore, I used it mostly during tutorial periods. What I really wished I had was a portable version so that we did not have to share computers with the general education students. My students really loved the avatars. They enjoyed using the SSD whenever they had the opportunity. The only negative from them was that they were upset when a word they wanted to learn was not there. One thing I thought was interesting was that they all preferred the Signed English version over the ASL version—maybe because they were trying to read along with the written definition and also to ‘keep up’ with the general education students. Overall, the SSD is a great tool. I know many districts, as well as my own, are pushing towards full inclusion with or without the support of D/HH teachers. I think finding a way to make the SSD more portable would make it great for those students in an inclusion setting.” (Note: Mobile versions of the SSD are under development.)

“I loved the way the SSD shows the whole definition in sign for those who don’t have the reading level. I also really like the speed control for the signs and the pictures. The only negative thing I could say is that I wish the SSD was even larger (in particular, I’d like to have the Pictionary for K-3 expanded). I just want to say, the SSD is great!!”

Post-use Student Feedback

As previously specified, students provided feedback via post-use surveys about their experiences with the SSD. The following summarizes their responses to this inquiry (N=93).

1. How easy was it to find information in the SSD?

Very easy—38

Fairly easy—40

Possible with a little trial and error—15

2. How did you use the SSD?

Learn the definition of a word—93; Learn how to sign a word—93; Learn a part of speech—12; See how things look—48; Tell what I know—15; Do homework—6

3. Why were you unable to find what you were looking for?

It was not there—86

It was hard to find so I gave up—7

4. Tell us how you found information in the SSD?

“The ABC order.”

“Used SEARCH.”

“I looked at the ABC list and clicked on the first letter. I looked in the list to find the word and clicked on it. I watched the signing person.”

“If I need to know what *cat* is, then I click the letter *c* and find *cat*. I click it, then watch the sign and then read the definition.”

“I click on ABCs then look in the list. I watch the sign and then read the words. For example, I look for letter *B* to find the definition for *biotic*. I watch the sign and read the words at the same time. I use the ASL and English.”

“First I go to the website. Then it will pop up when I type the word or click on ABC and look for the word. Then I click ASL and see the definition.”

“I find the word in the big list and click on it. (Sometimes) I typed in the word and then read it. I (also) used the link on the inside page.”

“I typed a word (I wanted to know). When the teacher wrote a word and told us to find information, then I clicked the word and learned all about it.”

“I just type a word and then the information pops up and tells what you are looking for.”

5. Tell us what you like about the SSD? What do you dislike?

“I like that it can go slow. I like the different people. I like the people signing in it better than looking for (the words) in the book.”

I wish I had it for other classes. I want to use it all the time and not have to wait (my turn) for a computer.”

“I like it because there is sign language in it. I didn’t like not being able to find some words”

“I like the people signing the sentences. The definitions were very clear.”

“I like SSD because I can learn how to sign new words. It makes it easy for me to understand because the person signs in ASL, and it is cool to learn new words.”

“I like it cuz it gives us the definition and signs, but I do not like it when the SSD does not have the word. I want all science words in SSD. It helps a lot with homework.”

“I like the (written) part of the definition of a word. It is very clearly (written). I like the SSD (and) dislike the book dictionary.”

“It is the first time that we have the SSD and signing. I like it all. There is nothing I dislike.”

“It is cool! Different people to sign is good.”

“It’s cool signing with the avatar. If we don’t know a word, we click on it and then we know it. The dictionary makes me smart. I can do everything myself.”

“Nothing is what I don’t like. I like it because it makes me understand clearly. I like it because it gives me more information than just the word, like pictures of what it is.”

“Mostly I like it because I can learn new signs for the words that I do not know the sign to. I don't like it when the words I want are not there. What I like about it is how fast it can sign. What I dislike is that when I search for a word sometimes it did not have it. I like being able to change the people and finding the words.”

“I wish it also had voice. I like the SSD. It looks pretty cool to me. I like the SSD better than the dictionary book.”

“I like the movie. That was awesome!”

“I like the SSD because it makes me feel more like learning. I like using sign language to make me understand the vocabulary. I like that it shows the definition in ASL. I like having the SSD to help me learn the signs and definitions of science words that I don't know. There is nothing I dislike about the SSD.”

“What I like is that the signing can go fast and slow. I like Pete. He’s a cool man.”

“I like that it shows the definitions and the signs for each word. I like the lizard man and that it has ASL. I don’t dislike anything. I like the explaining and that it helps me learn more.”

“I want them (avatars) in all my classes. I can make it go fast and slow. It's cool. If I don’t know, I click and know. I wish I wasn’t deaf. But it’s better this way because they (avatars) are like me.”